more than one third of the sutural margin. Wings very dark fuscous. Abdomen, cerci, and legs dark blue with metallic reflections, supra-anal lamina trigonal, sub-genital lamina cleft and valvular in appearance; cerci very long, with sparse erect pubescence, not acuminate. Formula of apical spines $\frac{1}{0}, \frac{0}{0}, \frac{0}{0}$, no genicular spine on front femora; front tibiæ with three apical spines and one spine beneath, mid and hind tibiæ with two widely separated spines above, four apical spines and a double row of spines beneath.

Total length 14 mm.; length of body 11 mm.; length of tegmina 11·5 mm.; pronotum 2·8 mm. × 3 mm.

Ecuador.

One example (Saunders collection, Oxford Museum).

This gorgeous little cockroach is also very like a Telephorid, but I have not been able to match it with any particular species.

In the preparation of this paper I have been much indebted to the kind assistance of my friend, Mr. G. J. Arrow, who has diligently searched the rich collections of Coleoptera in the British Museum for models to some of the remarkable mimetic cockroaches described above. Mr. Arrow has also supervised the preparation of the plate accompanying this paper.

EXPLANATION OF PLATE XLVIII.

Fig. 1. *Megapyga eximia* Boh.
2. *Prosoplecta bipunctata* Br.
3. *Oides biplagiata* Jac.
4. *Prosoplecta trifaria* Walk., ♂.
5. *P. coccinella* Sauss.
6. *P. nigra*, sp. n.
7. *P. gutticollis* Walk.
8. *Prioptera sinuata* Oliv.
9. *Prosoplecta nigroplagiata*, sp.n.
10. *Oides biplagiata* Jac., var.
11. *Prosoplecta trifaria* Walk., ♀.
12. *Leis dunlopi* Crotch.
13. *Prosoplecta semperi*, sp. n.
14. *P. quadriplagiata* Walk.
15. *P. mimas*, sp. n.
16. *P. rufa* Kirby.
17. *Melyroidea mimetica*, sp. n.
18. *M. magnifica*, sp. n.
19. *Prosoplecta cœlophoroides*, sp. n.
20. *Anisolemnia distaura* Muls.
21. *Cœlophora formosa* Crotch.

20. On the Pairing of Pseudoscorpiones.

By H. Wallis Kew, F.Z.S.

[Received January 20, 1912: Read February 6, 1912.]

(Text-figures 47–50.)

I. *Introduction.*

The breeding habits of Arachnida are of special interest from the fact that in no other Class do we find so great a diversity of method *. Much attention has been paid to the subject, and the main facts are established for most of the Orders. For Pseudoscorpiones, however, scarcely anything is known.

Rösel von Rosenhof, so long ago as 1755 (1), tells us that he kept these animals together for a long time in the hope of seeing

* *Cf.* Pocock (19), p. 2.

their pairing, yet without success. So also McIntire (5), who had great experience with several species in captivity, watched patiently for amiable traits, but all in vain. Schtschelkanowzeff, in fact, appears to be the only author who has seen the pairing of any animal of this Order. He states, in a memoir published in 1910 (17), that he saw this act frequently in a species of *Chelifer* (*Chernes*); and he has established the fact that fertilization is effected without intromission of a copulatory organ. But he did not see exactly what took place; and the remarkable details of the process remain, it is believed, quite unknown.

Mr. R. I. Pocock called the writer's attention to this subject in 1903, since which time a careful watch has been kept on these animals, both in the open and in captivity.

The captive individuals, it may be explained, were housed in what are known as "McIntire cells"; that is to say, in little cases about three inches long, an inch or so broad, and a quarter of an inch or less high. The body was of sheet-cork, the floor of glass covered with blotting-paper, and the roof of clear glass; the whole being held together by rubber-bands. The glass forming the roof was transversely cut and hinged, so that food and moisture could be readily administered *. In these abodes the animals lived in health for a long time, and they were easily watched both under low powers of the microscope and with a lens. Observation was facilitated, it may be added, by the animals walking on the under surface of the roof, so as to expose to view the genital area, which occupies in this Order the usual position at the base of the abdomen.

The sexes meet in ordinary walking position head to head, and, after some preliminary fencing, the male manages to grasp with one or both of the hands of the palps one or both of the hands of the palps of the female. Early observations showed this to be the case in *Chelifer cimicoides* Fabr.†, whose pairing, however, has not yet been fully made out. Similar behaviour was afterwards witnessed in the relatively gigantic *Chelifer cyrneus* L. Koch, and it was on this species that most of my observations were made. First of all, however, something must be said of *Chelifer latreillii* Leach, an animal subgenerically distinct from those just named and one of considerable interest in many respects.

II. *Pairing of* Chelifer latreillii *Leach.*

Chelifer latreillii, always maritime in Britain, ranges with us from Fifeshire to Sussex, and is excessively abundant on the great sand-dunes of the coasts of Lincolnshire and Norfolk. In such places it makes its home for the most part in the tussocks of *Ammophila arenaria*; but it evidently moves about freely, being found often under pieces of wood, etc., on the sandy ground.

It belongs to the subgenus *Chelifer* s. s., a small group

* *Cf.* McIntire (4), pp. 71–2.

† For the nomenclature employed in this paper, *cf.* Kew (18).

remarkable for the specialization of the male, in which both primary and secondary characters are unusually pronounced *. The genital area of this sex is large and conspicuous, the first genital plate being short and of peculiar character, while the second is both long and broad, and under this latter are found two very large structures, inappropriately called ram's-horn organs, to which it will be necessary to recur. The fourth pair of coxæ, which bound the genital area anteriorly, differ much from those of the female, being strongly concave behind and containing a peculiar organ, the coxal sac of With (13). Of characters remote from the genital area there is considerable diversity within the group; there are generally remarkable modifications in the legs of the first pair, and these modifications are unusually well-marked in the present species. The whole leg is greatly strengthened, with hump-backed tarsus, and greatly enlarged claws, the anterior claw being of peculiar shape with oddly turned extremity and with a process along its anterior margin. Further, while the hand of the palp is a little smaller than that of the female, the fingers when closed at the tip have a wider gape.

The ram's-horn organs already mentioned—supposed to be tracheal in origin—have been studied in allied species by several authors†. They are concealed under the second genital plate, where they lie in a highly contracted condition. Preserved specimens, in exceptional cases, have them protruded externally; and they have been figured thus protruded by Simon (6), and after him by Tömösváry (7); and by With (16). It does not appear, however, that they have been seen in action; and the suggestion of Menge (2) and Simon (6) that they are sperm-transmitters, perhaps intromittent organs‡, is erroneous, as also is that of Schtschelkanowzeff (17), who thought they might be concerned in placing sperm-masses on the ground.

With regard to the other characters, except that With (14) and Schtschelkanowzeff (17) have supposed the coxal sac to be a sense-organ with some sexual significance, no suggestions appear to have been made. The gape of the fingers, however, is obviously connected with the grasping of hands already mentioned; and the observations now recorded show what is done with the ram's-horn organs and with the legs of the first pair.

It was in May 1905, on the sand-dunes between Sandwich and Deal, that I first saw the meeting of the sexes of this animal. On turning over a piece of tin, I found on its under surface a male and female which had approached each other head to head, and were actively fencing with the palps. The male at length disarmed the female by getting a firm grasp of the hands, which were held fast during the whole of these preliminary proceedings.

* With (14), pp. 132–3; With (16), p. 220; Kew (18), p. 47.

† Menge (2), p. 17, pl. ii. fig. 12; Hansen (8), pl. vii. fig. 2*h*; Croneberg (9), pp. 456–7, pl. xi *a*. figs. 45–47; Bernard (10), pp. 423–6; Oudemans (15), pp. 136–140; Schtschelkanowzeff (17), pp. 6–14.

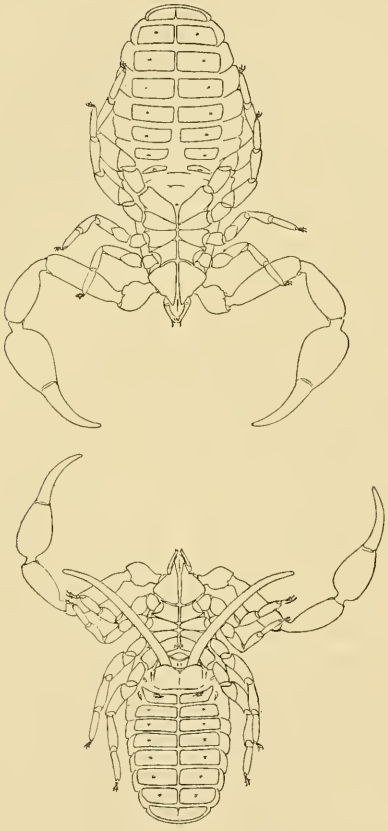
‡ On the supposed occurrence of intromittent organs in this Order, *cf.* Lankester (12), p. 256; and Croneberg (9), p. 39.

The animals moved considerably backwards and forwards and round about; and the male, all the time in a state of great activity, made at intervals determined advances towards the female, but he was prevented from approaching closely. On the occasion of each of these advances the male brought the ram's-horn organs into action, running them out rather rapidly to their full extent; they took at these times a forward lateral direction, their extremities usually assuming an outward curve and passing under or over the femora of the male's palps. Occasionally they touched some part of the palps of the female, but this seemed accidental. At the full extension of the organs, the male vibrated his body in a peculiar manner and had at this time a remarkable, even villainous appearance; but the organs were exposed only for a few moments, after which they ran in again rather rapidly, the male then taking a few steps backwards. Eventually the animals separated—perhaps disturbed by the sunlight to which they were exposed—without proceeding to any act of fertilization. In 1906, also in May, similar observations were made on specimens collected on the Lincolnshire coast, but again no act of fertilization was seen; and no more observations were made till the spring of 1911. In the third week of April in that year, a good number of specimens were collected on the Camber sand-hills in Sussex; and they were kept under daily observation in one of the cells above described. During the remaining days of April and the early days of May, the males, which had the abdomen rather full, seemed to have difficulty in restraining the ram's-horn organs, the tips of which constantly appeared from under the great genital plate, which was at such times raised anteriorly and depressed into the abdomen posteriorly. Many fencing contests between male and female were seen; but the male did not always obtain any advantage in the grasp and was often in fact rather roughly used; he continued, however, even at these times, to display the ram's-horn organs with great energy. As before, I failed to observe the acts of fertilization. It was evident, however, that such acts had occurred, either before or after the animals came under observation, for about a month later eggs began to appear externally on a few of the females, and in the first week of July young broods appeared. Shortly before this time, fortunately, that is to say about mid-summer, there was a recurrence of sexual activity in the cell; and on 22nd June the whole process of the passing of the male product to the female was successfully witnessed.

The animals, male and female, had taken up a position, ventral face uppermost, on the under surface of the glass; and the male, who was firmly holding both hands of the female, was making periodical advances towards her with display of the ram's-horn organs as above described. It soon became evident that the female was offering but slight resistance; the male was allowed to make a near approach, and at length he was even permitted to caress with his cheliceræ the cheliceræ of the female. This done, he quickly retired as before by taking a step or two backwards;

and it was now seen that as he did so the female was quite eager to take the corresponding steps forwards. As this tendency became more and more marked, the male released his grasp of the hands of the female, who was now free, at least from corporal

Text-fig. 47.



Chelifer latreillii Leach.

Male and female; in ventral view, seen through a piece of glass, on the under-surface of which they are standing. The position is that of the last phase of the courtship; the male has released the hands of the female, and is about to extrude the spermatophore; the ram's-horn organs are fully extended or nearly so. × 13.

(The bristles and tactile-hairs are omitted.)

control. The male continued, however, to make advances and to display the ram's-horn organs even with greater energy than before; and finally, on the occasion of one of these advances—while

not in contact with the female in any way—the ram's-horn organs being fully extended (text-fig. 47), he extruded from the genital opening between the bases of these organs a large elongated structure—evidently a spermatophore *—one extremity of which became at once attached to the glass by means of a foot-like pad of quick-drying adhesive matter. The other extremity was still in contact with the genital opening of the male; and when thus freshly extruded this spermatophore bore externally, somewhat near the middle, some clouded liquid in the form of a moderately large surrounding globule. After a delay of a few moments, the male stepped backwards, and thus released the spermatophore, leaving it attached to the glass as just mentioned, but otherwise free, in an oblique position, with the unattached extremity directed towards the male. No sooner had the male thus stepped back, than the female came quickly forward till the female genital opening was in contact with the spermatophore. This forward movement of the female was accompanied, I believe, by a slight but rapid forward movement of the male; and, however this may be, the head of the male had passed under that of the female; and at the same moment, with great suddenness, the male threw forward the stout legs of the first pair and seized with them the anterior margin of the female genital opening, on which the enlarged peculiarly formed claws became firmly hooked; and now the male commenced a rather long series of violent pulling movements with these legs, by means of which the body of the female was moved on the spermatophore, a part of which had, I believe, entered the female genital opening. These movements brought the proceedings to a close, and the animals now separated, leaving the spermatophore, or at least the shell of it, still attached by its foot to the glass. No repetition of these acts was observed. Another spermatophore was found in the cell, however, towards the end of August.

Text-fig. 50 A (p. 386) shows the spermatophore from above and from below. It was of firm substance and somewhat complicated in structure. Beyond the foot of attachment it was rather slender but it gradually increased towards a neck-like constriction, beyond which was a widened head with a small horn-like point on either side; and beyond this head was a rather long narrowed extremity of definite construction. The total length was considerably more than half that of the entire animal.

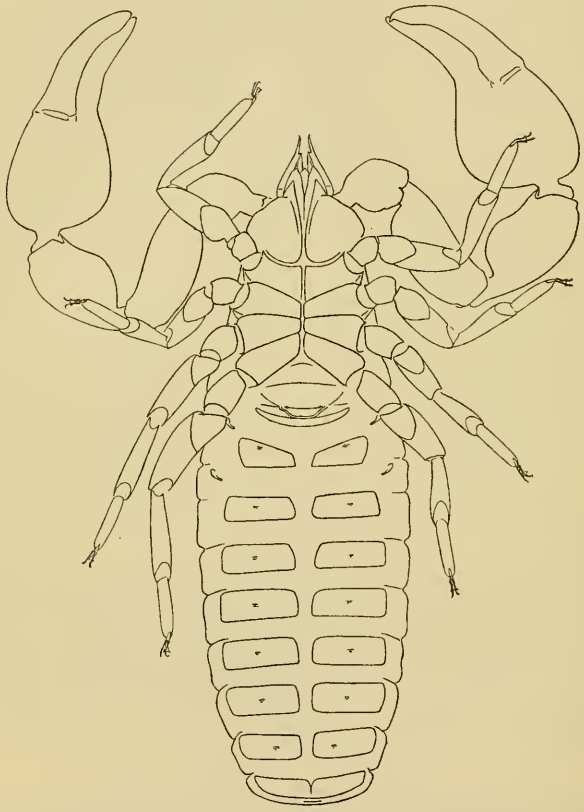
III. *Pairing of* Chelifer cyrneus *L. Koch.*

Chelifer cyrneus is known with us only in Sherwood Forest (Nottinghamshire) and Richmond Park (Surrey), where it lives under rather close-fitting bark of dead or partly dead oak-trees.

* The occurrence, in this Order, of a spermatophore, though not mentioned in the text-books, is not entirely new, since McIntire (5) saw *Chthonius* ♂, in captivity, extrude elongated structures in which were spermatozoa. No female appears to have been associated with the male during this act, and it is thus doubtful whether the extrusion was normal.

It belongs to the subgenus *Chernes*; and the male (text-fig. 48), in sharp contrast with that of *Chelifer latreillii*, is but little specialized. The genital area of this sex is only moderately conspicuous, the second genital plate being short; the fourth pair of coxæ differ only a little from those of the female, and there is no coxal sac; further, there are no protrusible ram's-horn organs, and the legs of the first pair exhibit no marked modification. A slight enlargement of the hands of the palp, in fact, is the only secondary character of note.

Text-fig. 48.



Chelifer cyrneus L. Koch.

Male in ventral view. × 20.
(The bristles and tactile-hairs are omitted.)

Compared with *Chelifer latreillii*, the present animal is much larger and more heavily built, and unlike the former species, it is

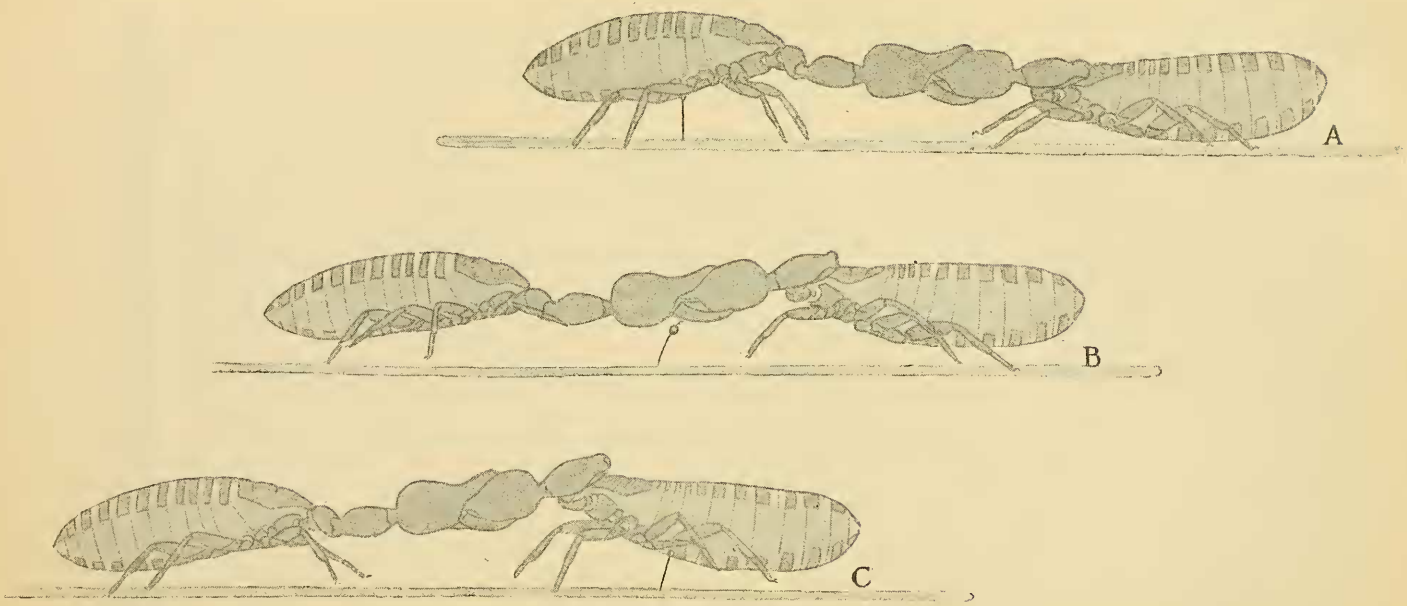
eyeless. In the male, in addition to the important differences above indicated, there is a deep-seated unlikeness in the internal organs; and we shall find that the spermatophores are entirely unlike, with corresponding differences in the pairing.

In the second week of April 1911, a supply of specimens was obtained from Richmond Park *, and a cell was stocked with five or six individuals, which were kept under daily observation till the beginning of the second week of May. During this time, fortunately, abundant opportunities were afforded for observing the pairing, which was carried on with great persistence on at least eight occasions. The animals did not walk easily on the under surface of the glass, and pairing was not observed in that position; it was well seen, however, both in dorsal and lateral view, and under the latter condition the details of the process were distinctly made out.

The male and female met, as already stated, in walking position head to head (text-fig. 49, p. 384); and, as in the former species, they engaged in some preliminary fencing with the palps. During this fencing the male always obtained with one of the hands a firm grasp of one of the hands of the female; and, contrary to what occurred in the former species, this grasp was always maintained throughout, that is to say until the animals parted company when the pairing for the time being was complete. Moreover, while the former species held the female with both hands, the present animal invariably employed one hand only in this way, always keeping the other hand free. After the grasp was made, the animals fenced with the free palp and moved about a little backwards and forwards; the male—all the time alert and eager—constantly attempting to approach closely to the female. Watching the animals carefully at this time, it was soon observed that the fencing had given place to a regular system of display on the part of the male, whose actions in this respect were quite unlike anything seen in the former species. In the present case—in the absence of ram's-horn organs—the display was made with the free palp and with the legs of the first pair. The free palp was brought round at frequent intervals and the great hand rapidly shaken in the face of the female in a remarkable threatening or perhaps beckoning manner; and the first legs were rapidly moved, that is to say lifted and replaced, in most peculiar fashion. After a time the female, apparently much impressed with these actions, offered little or no resistance, the male having now no difficulty in approaching closely. At length the male—head to head with the female but not in contact except for the continuous grasp of one hand—deflected the base of the abdomen to the floor and affixed there the adhesive foot-like attachment of the spermatophore. Almost immediately, the body was raised to its normal position,

* The writer is indebted to His Majesty's Office of Works and to Mr. S. Pullman, the Superintendent of the Park, for the permission and facilities necessary for the taking of the animals in this place.

Text-fig. 49.



Pairing of *Chelifer cyrneus* L. Koch. × 10.

A. Female confronted by male with completed spermatophore. **B.** Male retiring backwards, female coming forwards to the spermatophore. **C.** Female receiving the sperma.

(The appendages of the left side of the male and of the right side of the female, the bristles, and the tactile-hairs are omitted.)

and one then saw that a whitish filament was stretched from the foot-like attachment to the genital opening; and now the male produced very quickly from the genital opening a large globule of brilliant liquid; and this globule remained on the filament, just below the genital opening, like a great bead on a thread. Standing thus for some moments, perhaps awaiting some sign from the female, and continuing with great energy the shaking of the free hand, the male at last quickly raised his body and took a step or two backwards so as to free the globule and filament; and it was now seen that the filament, which passed through the globule, bore just above it a small irregular termination of whitish substance. The remarkable spermatophore thus completed remained standing on the ground in an erect or suberect position. At the moment when the male raised his body and stepped back, the female, still held by the hand by the male, ran forward; the movement of the two animals being perfectly mutual and just sufficient to bring the genital area of the female into the exact position occupied the moment before by that of the male. As the female thus ran forward the genital orifice was widely open; and just as the spermatophore was reached a slight forward and downward movement was made upon it; and, the genital orifice being quickly closed, the globule together with the whitish termination of the filament were taken in at a gulp. Only the naked filament remained. At the moment of this rapid gulping in, the female drew back; and at the same moment the male, with great eagerness and with the chelicerae extended and open, ran forward until the fore parts of male and female were in contact; and the two animals remained thus in a state of quiescent embrace for some time. During this embrace the head of the male went under that of the female; but no part of the male was at any time directed towards the female genital opening. The coupling action of the legs of the first pair, which appears to be an essential condition in the pairing of *Chelifer latreillii*, had no counterpart in the present species. At the conclusion of this period of repose, the male roused himself to activity again, recommenced the rapid movements of the free palp and of the legs of the first pair, and the whole process was repeated.

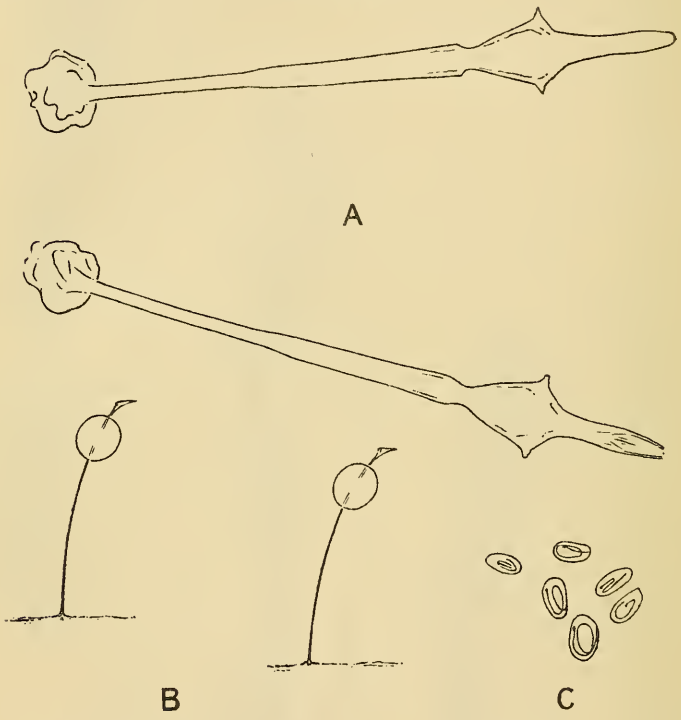
The whole process was, in fact, always repeated many times. To this there was no exception in all the observations. The male never once released, not even during the periods of repose, the fixed grasp of the hand of the female; spermatophores were regularly produced and received at intervals of from eight to ten minutes; and this recurrent pairing was continued for two hours, or even for three hours, or more.

By the beginning of the second week of May the activity of the males showed signs of abating, and the colony was broken up. Soon afterwards, however, a new colony was established, and pairing was seen again in July and August.

Text-fig. 50 B shows the spermatophore—two of them—in lateral view. This object agrees with that of the former species in its attachment to the floor, but is otherwise of different character,

being altogether more simple and smaller. Beyond the small foot of attachment it consists, as we have seen, merely of a simple, more or less rigid filament, which bears around it near the top a large globule of liquid and has just above the globule an irregular termination of whitish substance.

Text-fig. 50.



A. Spermatophore of *Chelifer latreillii* Leach, from above and from below. × 50.

B. Spermatophores of *Chelifer cyrneus* L. Koch, from the side. × 50.

C. Spermatozoa of *Chelifer cyrneus* L. Koch. (Drawing communicated to the writer by Mr. C. J. With.)

The globule has a diameter somewhat exceeding the depth of the tibia of the legs of the animals. Unfortunately it was not ascertained whether the spermatozoa (text-fig. 50 C) were contained in the globule or above it at the termination of the filament—from my experience in this direction the obtaining of a complete spermatophore for examination will not be an easy task—but however this may be, the amount of material transferred from the male to the female is surprisingly large.

On the breaking up of the first colony, the animals were despatched to Mr. C. J. With of Copenhagen, who obligingly examined them, and found spermatozoa in the females. These formed a mass in the vagina ; and occurred also, placed in a single row, in the two long narrow irregularly-coiled tubes which run out from the vagina anteriorly. These tubes were figured in an allied species by Croneberg (9). From their structure, and from the presence of spermatozoa which would evidently be preserved there, they must be regarded as receptacula seminis, not as glands as Croneberg supposed *.

It was on the present species that Schtschelkanowzeff (17) made the already published observations to which reference is made at the commencement of this paper †. He found the animal in the Russian Government of Tschernigoff, in a forest belonging to his father, where certain pine-stumps were reserved for the purposes of observation. By removing the bark from these stumps he was able to learn much of the animal's manner of life, and frequently saw their pairing. He relates that after the grasping of one hand and other preliminaries, the male made some convulsive movements and depressed the abdomen to the stump ; and thereupon the female took the place of the male and depressed her abdomen exactly at the spot where the male had done so ; and these actions were repeated several times. The male, he concluded, had deposited sperm and the female had taken it up ; and on subsequent dissection of the female, spermatozoa were detected in the vagina and receptacula seminis. This impression of the pairing, it will be seen, is roughly in agreement with the account above given ; it is, in fact, exactly what would be obtained by a not very close observation of the animals in dorsal view, in the open, with or without a lens. Presumably they were not viewed laterally, for the sperm was supposed to have been deposited in little heaps ; and thus there is no mention of the characteristic spermatophore. Schtschelkanowzeff supposed, finally, that the active rôle was taken throughout by the female ; but in this, doubtless, he was mistaken.

IV. *Summary.*

The two Pseudoscorpiones observed belong to the genus *Chelifer* s. l., and represent respectively the subgenera *Chelifer* s. s. and *Chernes*.

The males are differently equipped : the *Chelifer* has an elaborate genital area, long ram's-horn organs, and much modified legs of the first pair ; the *Chernes* has a less elaborate genital area, no ram's-horn organs, and no modified legs. There is agreement,

* This result appears to have been arrived at already by Schtschelkanowzeff (17, p. 27), and *cf.* Lubbock (3, p. 615).

† Schtschelkanowzeff (11) described his animal as *C. multidentatus*, sp. n. ; but paratypes obligingly communicated to the writer establish its identity with *C. cyrneus*.

however, in a feature of prime importance: both are destitute of intromittent organs of copulation.

Fertilization is effected in both by means of a spermatophore.

This structure in the *Chelifer* is large and somewhat complicated; in the *Chernes* relatively small and merely filiform.

Correlated with the differences in equipment and in the spermatophore are considerable differences in the pairing.

There is agreement, however, as follows. The male and female face one another in walking position. The male grasps with one or both hands one or both hands of the female. There is a forced courtship, during which the male makes display of definite character. At length he extrudes the spermatophore, which is attached to the floor in front of the female, where it stands erect or obliquely. From this object the male retires backwards, and the female at the same moment comes forwards. The movement is just sufficient to bring the female genital opening into contact with the spermatophore, and the male product is thus received without delay.

The differences may thus be stated. The *Chelifer* male holds the female with both hands; and makes display with the ram's-horn organs. He releases the hands previously to the extrusion of the spermatophore. When the female comes forward, he seizes her by the genital opening with the legs of the first pair, and then executes a series of pulling movements by which presumably the reception of the male product is facilitated. The animals now separate; and it is unlikely that the process is repeated, except perhaps at long intervals. The *Chernes* male holds the female with one hand only. He makes his display with the other hand and with the legs of the first pair. He does not release the female previously to the extrusion of the spermatophore, but continues to hold her by the hand throughout. When the female reaches the spermatophore, she takes the male product quickly and retires backwards. There is no seizing of the genital opening by the male. As the female retires, however, the male quickly follows; and there is a period of repose; after which the whole process is repeated. Moreover, it is repeated, with similar periods of repose, many times; and a large number of spermatophores are thus produced and received in rather quick succession.

By way of conclusion it may be recalled that the genus *Chelifer* s.l. comprises, in addition to the subgenera *Chelifer* s.s. and *Chernes*, two others, *Atemnus* and *Withius*: all distinguished by remarkable differences in the sexual equipment of the males—even within the subgenera there are striking divergences in the secondary characters; and these facts, in view of the differences above noted, certainly lead one to expect great variations in the pairing processes. A review of the males of the whole Order, moreover, serves greatly to increase this expectation—one may refer for instance to the complete dissimilarity in the genital areas of *Obisium* and *Chthonius*—so that there is here undoubtedly

a fertile field for investigation. Nevertheless it may perhaps be predicted that the general lines now indicated are those on which fertilization will be found to be effected in all Pseudoscorpiones.

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EXHIBITIONS AND NOTICES.

February 20, 1912.

Dr. A. Smith Woodward, F.R.S., Vice-President, in the Chair.

Dr. A. T. Masterman, M.A., F.Z.S., gave a demonstration, illustrated by a large number of lantern-slides, of recent investigations on Age-determination in the Scales of Salmonoids, with special reference to Wye Salmon.

March 5, 1912.

Sir John Rose Bradford, M.D., D.Sc., F.R.S., Vice-President, in the Chair.

The Races of the European Wild Swine *.

Mr. Oldfield Thomas, F.R.S., F.Z.S., exhibited the skull of a Hungarian Wild Boar, recently presented to the National Museum by Fräulein Sarolta von Wertheimstein, and that of an ordinary German Wild Boar, representing the typical *Sus scrofa* Linn.

* [The complete account of the new forms described in this paper is given here, but since the names and preliminary diagnoses were published in the 'Abstract,' they are distinguished by being underlined.—Editor.]